

# 780 nm Single-frequency Laser Source for High Spectral Resolution Lidar, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



## ABSTRACT

High energy narrow-linewidth and frequency stable laser transmitter at 780 nm is in great demand for the development of low-cost, compact, and eye-safe high spectral resolution lidar (HSRL) for accurate aerosol and cloud profiling and distinguishing among different aerosol types. NP Photonics proposes to develop a 780 nm laser source capable of generating 20 mJ nanosecond pulses at a repetition rate of 10 kHz with wavelength tunability  $> 0.5$  nm by use of our proprietary and mature highly doped short-length fiber amplifier technology and innovative Innoslab amplifier technology. The advantages of our proposed laser system include high reliability, narrow-linewidth, super stability, high spectral purity, robustness and compactness.

## ANTICIPATED BENEFITS

### To NASA funded missions:

Potential NASA Commercial Applications: High energy single-frequency laser source at 780 nm can be used for next generation high spectral resolution lidar to accurately characterize and discriminate aerosol type and significantly improve both measurement retrievals and modeling on climate. Compact and robust single-frequency lasers at 780 nm can also be used by NASA for airborne and spaceborne laser cooling and manipulation of Rubidium, which has been extensively used in atomic vapor based instruments for sensing and metrology.

### To the commercial space industry:

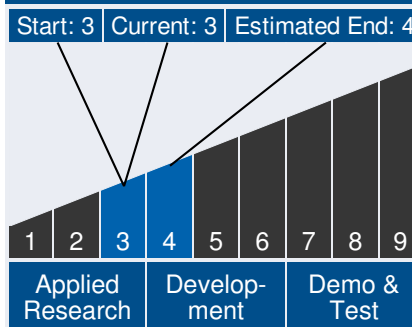
Potential Non-NASA Commercial Applications: A 780 nm single-frequency laser can be locked to the transition of Rubidium to be a very stable secondary frequency reference (rubidium oscillator) for maintaining frequency accuracy in cell site transmitters and other electronic transmitting, networking and test equipment. Single-frequency fiber lasers at 780 nm can also be used for atomic interferometer, optical communications, atomic clock, GPS-free navigation, oil exploration, and mine



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## Technology Maturity



## Management Team

### Program Executives:

- Joseph Grant
- Laguduva Kubendran

### Program Manager:

- Carlos Torrez

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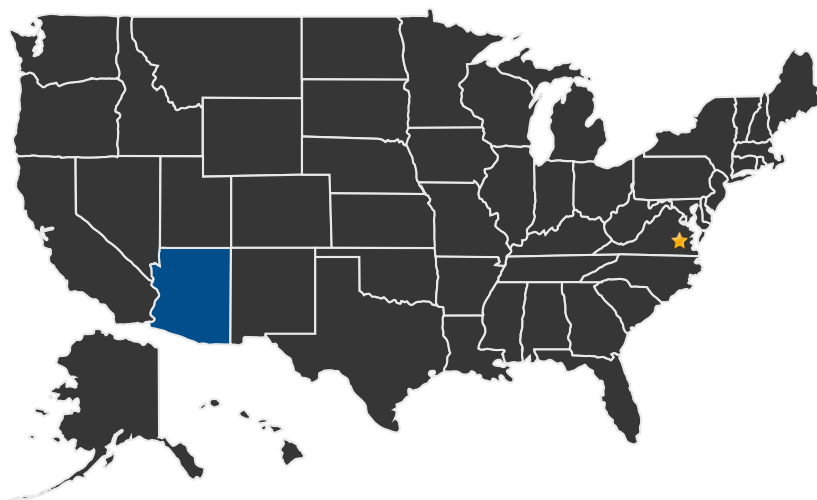
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detection. In addition, the 780 nm single-frequency lasers can be frequency doubled to produce high stability and narrow-linewidth UV lasers that have found applications in Raman spectroscopy, laser cooling and trapping, laser inspection, optical data storage, biomedical applications, and maskless laser lithography.

## U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States  
With Work

★ **Lead Center:**  
Langley Research Center

## Other Organizations Performing Work:

- NP Photonics, Inc. (Tucson, AZ)

## PROJECT LIBRARY

### Presentations

- Briefing Chart
  - (<http://techport.nasa.gov:80/file/23319>)

### Management Team *(cont.)*

#### Principal Investigator:

- Xiushan Zhu

### Technology Areas

#### Primary Technology Area:

Science Instruments,  
Observatories, and Sensor  
Systems (TA 8)

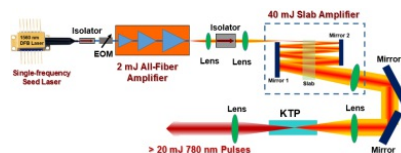
└ In-Situ Instruments and  
Sensors (TA 8.3)

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## IMAGE GALLERY



*780 nm Single-frequency Laser Source  
for High Spectral Resolution Lidar,  
Phase I*

## DETAILS FOR TECHNOLOGY 1

### Technology Title

780 nm Single-frequency Laser Source for High Spectral Resolution Lidar, Phase I

### Potential Applications

High energy single-frequency laser source at 780 nm can be used for next generation high spectral resolution lidar to accurately characterize and discriminate aerosol type and significantly improve both measurement retrievals and modeling on climate. Compact and robust single-frequency lasers at 780 nm can also be used by NASA for airborne and spaceborne laser cooling and manipulation of Rubidium, which has been extensively used in atomic vapor based instruments for sensing and metrology.